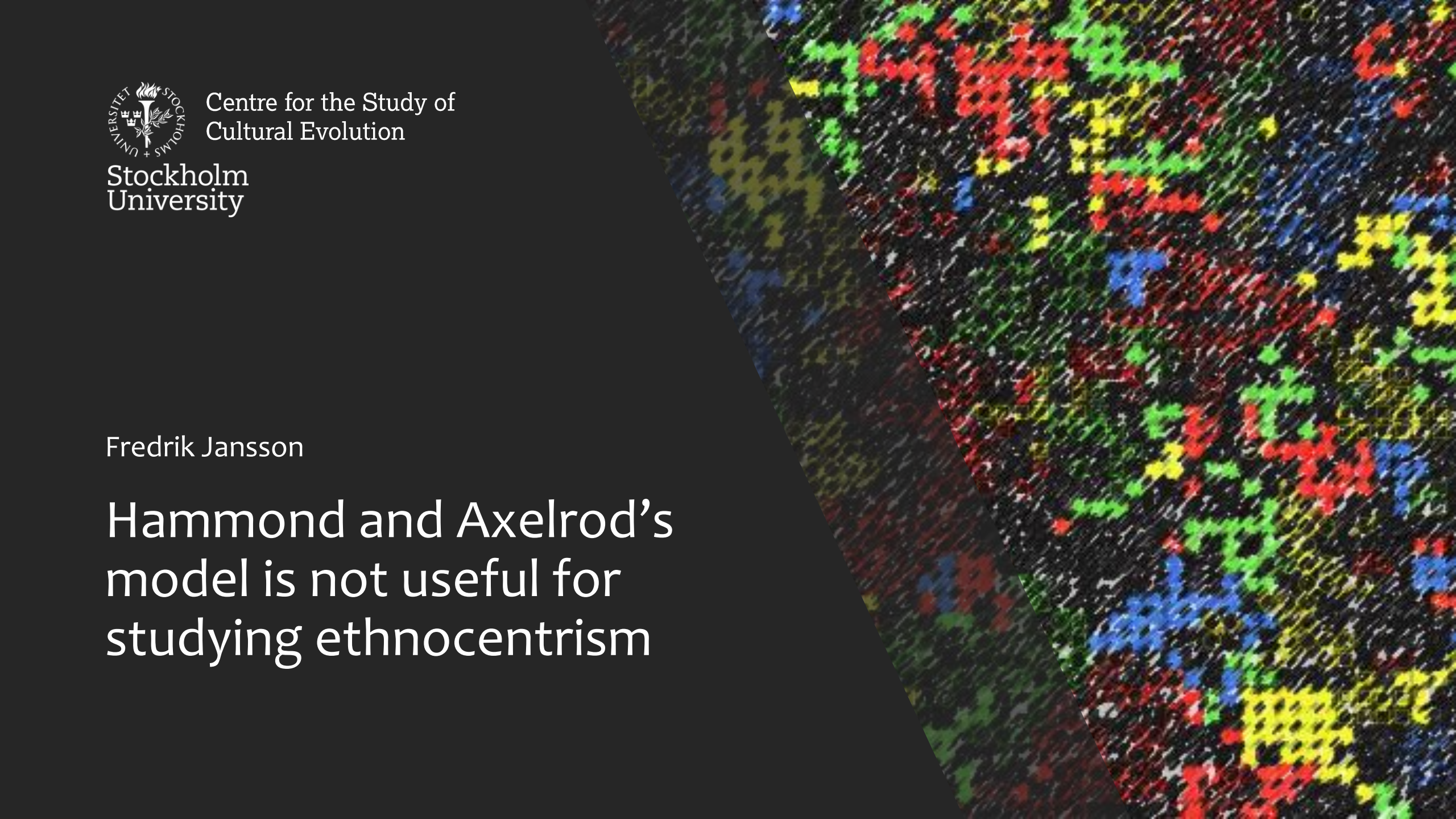


Centre for the Study of
Cultural Evolution

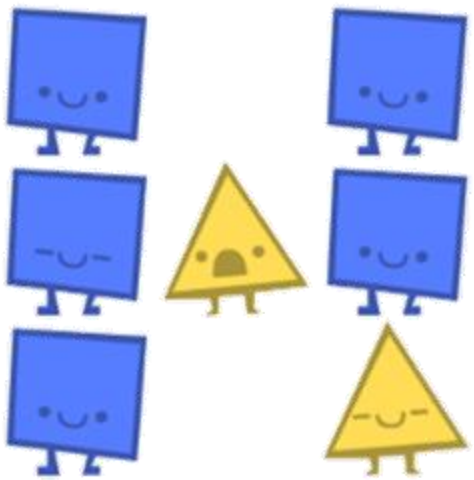
Stockholm
University

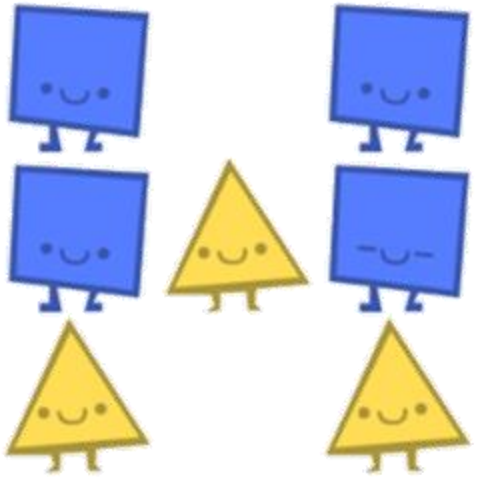
Fredrik Jansson

Hammond and Axelrod's model is not useful for studying ethnocentrism

The Segregation Model

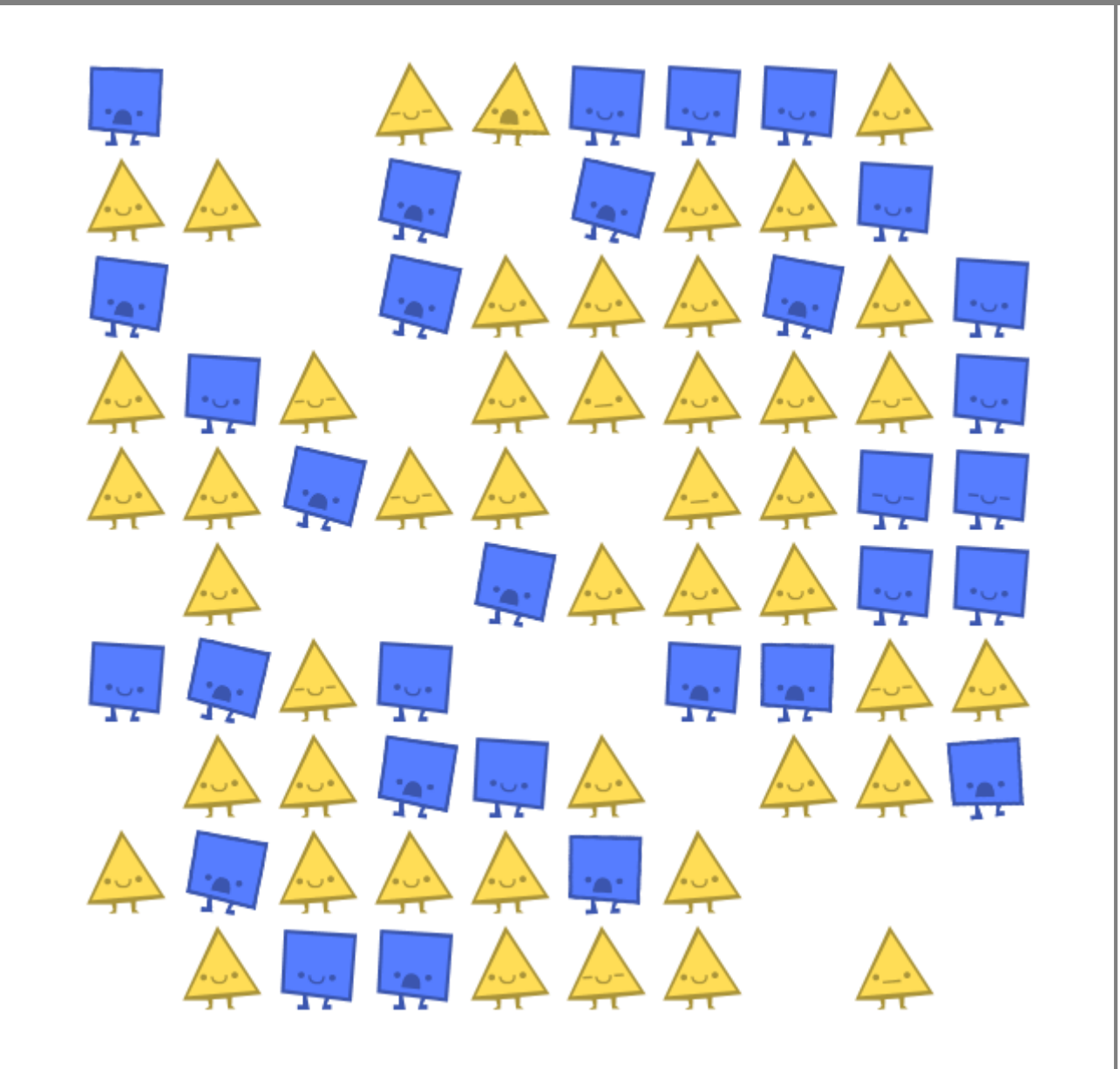
Schelling 1971

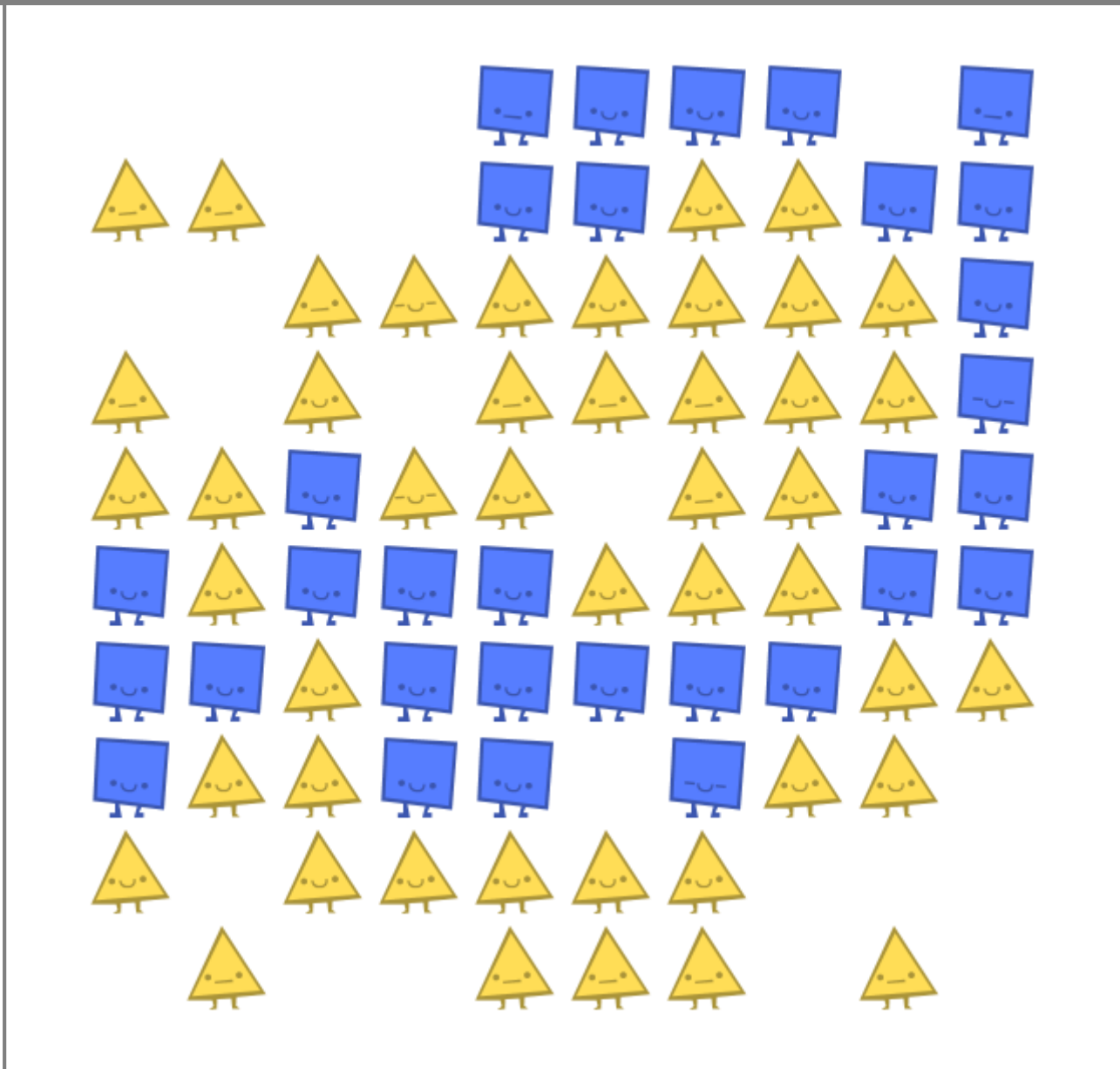




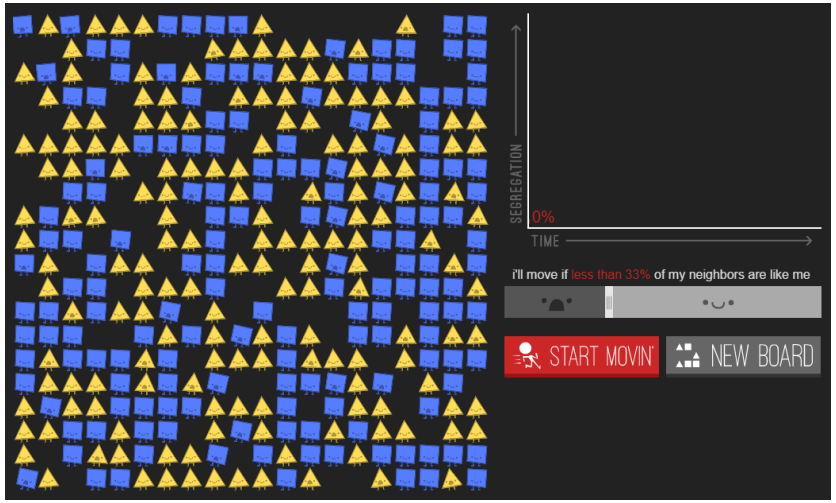
ncase.me/polygons

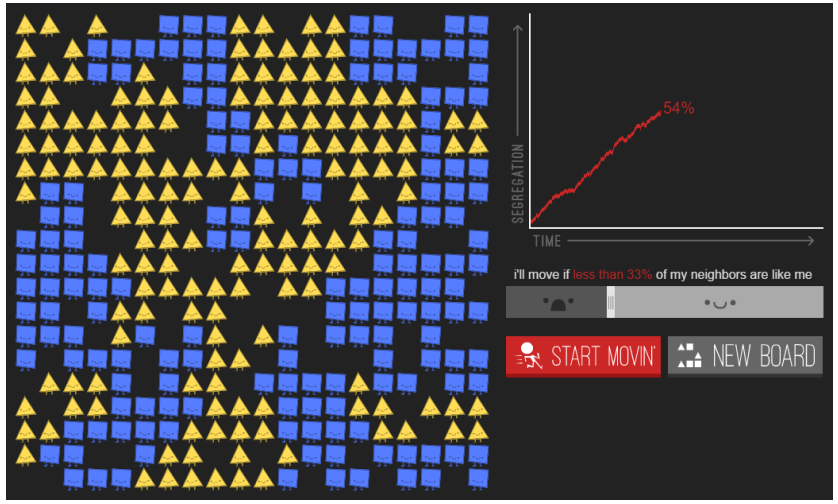
The Segregation Model

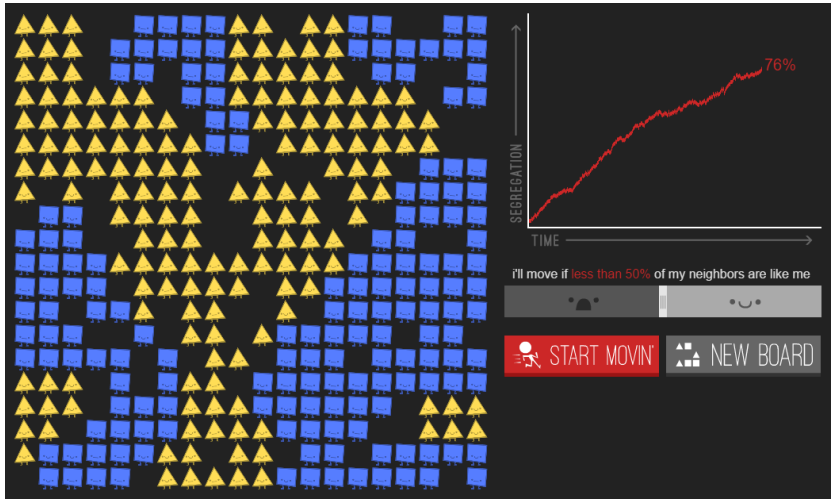




The Segregation Model







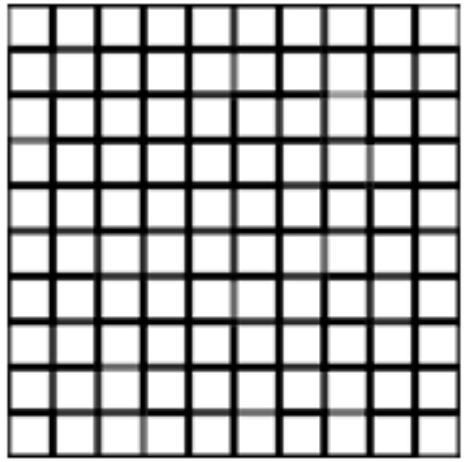
The Dissemination of Culture Model

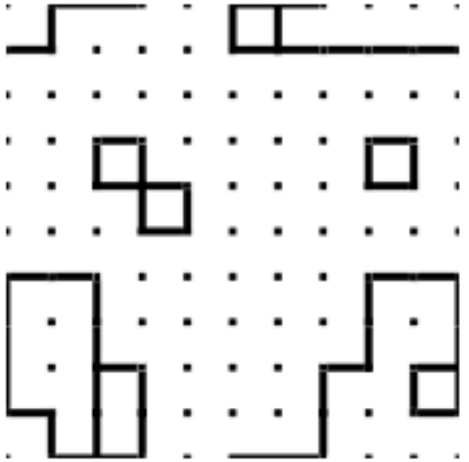
Axelrod 1997

A Typical Initial Set of Cultures

74741	87254	82330	17993	22978	82762	87476	26757	99313	32009
01948	09234	67730	89130	34210	85403	69411	81677	06789	24042
49447	46012	42628	86636	27405	39747	97450	71833	07192	87426
22781	85541	51585	84468	18122	60094	71819	51912	32095	11318
09581	89800	72031	19856	08071	97744	42533	33723	24659	03847
56352	34490	48416	55455	88600	78295	69896	96775	86714	02932
46238	38032	34235	45602	39891	84866	38456	78008	27136	50153
88136	21593	77404	17043	39238	81454	29464	74576	41924	43987
35682	19232	80173	81447	22884	58260	53436	13623	05729	43378
57816	55285	66329	30462	36729	13341	43986	45578	64585	47330

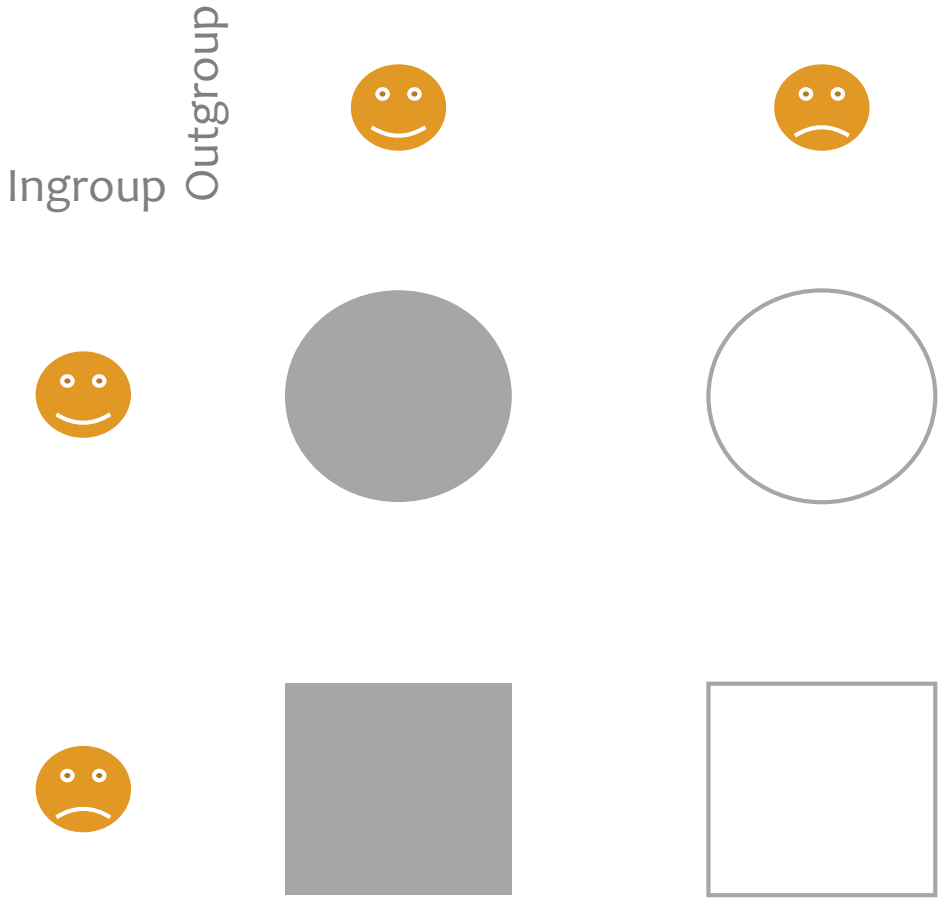
NOTE: The underlined site and the site to its south share traits for two of the five cultural features, making a cultural similarity of 40%.

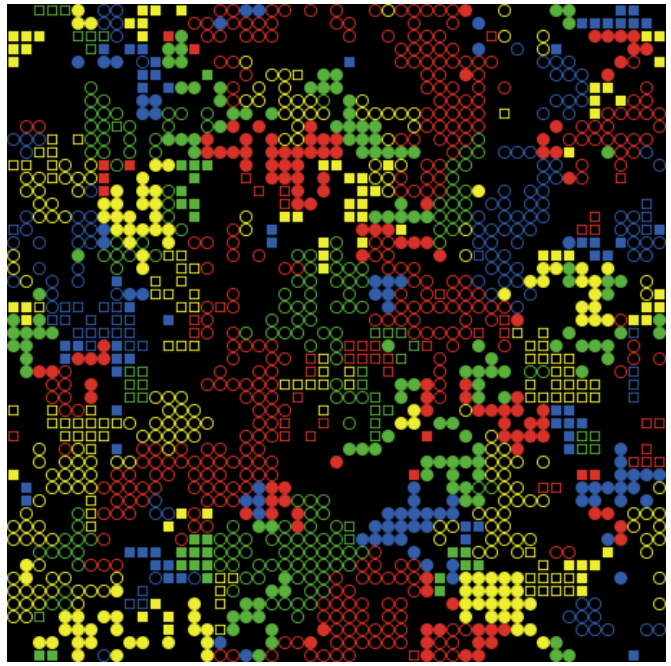




The Ethnocentrism Model

Hammond and Axelrod 2006





Ethnocentrism

Oxford English Dictionary

ethnocentric, *adj.*
Pronunciation: Brit. /ˌɛθnə(ʊ)'sɛntrɪk/, U.S. /ˌɛθnoʊ'sɛntrɪk/
Origin: Formed within English, by compounding. **Etymons:** ETHNO- *comb. form*, -CENTRIC *comb. form*.
Etymology: < ETHNO- *comb. form* + -CENTRIC *comb. form*.

Tending to view the world from the perspective of one's own culture, sometimes with an assumption of superiority; limited as regards knowledge and appreciation of other cultures and communities. Also in neutral sense: aware of membership of an ethnic group, community, or culture.

Ethnocentrism

Ingroup bias

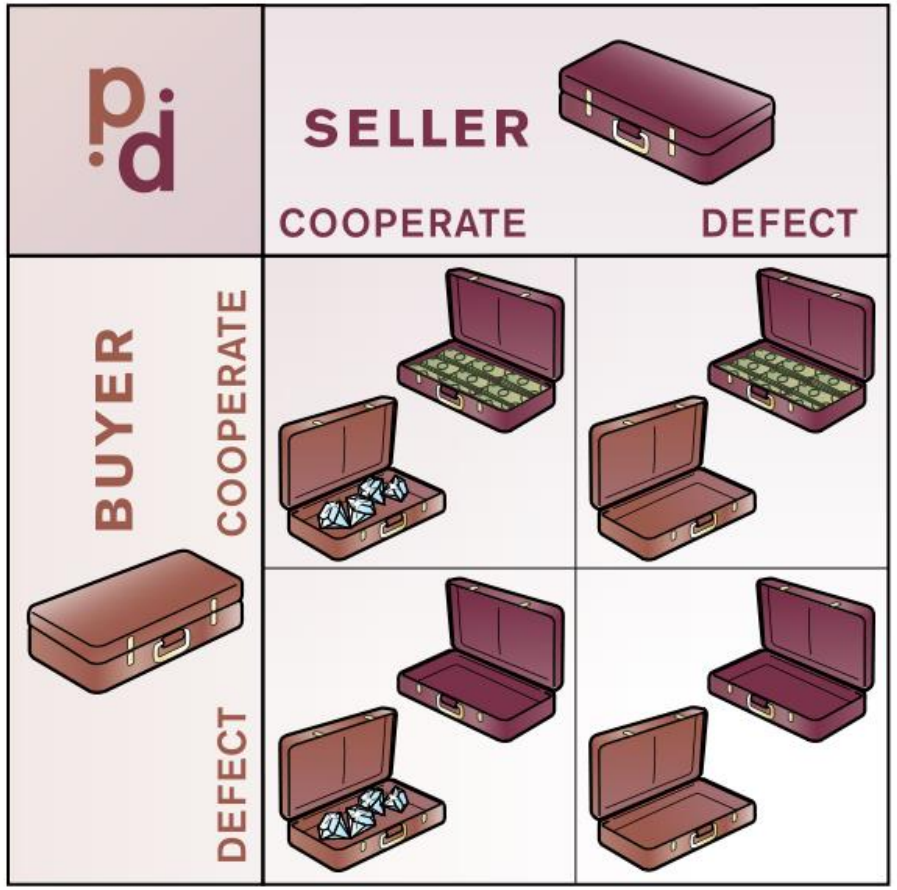
Tag-based co-operation

Mechanisms and outcomes

Schelling	Axelrod	Hammond & Axelrod
Moderate preferences for homogeneity	Local convergence	Clonal interaction
⬇	⬇	⬇
Segregation	Global polarisation	Tag-based co-operation

The prisoners' dilemma

The common good …	If you help me, then I benefit more than it costs you to help
	If I help you, then you benefit more than it costs me to help
	The commonly best outcome is if we help each other
… conflicts with self interest	No matter what you do, I benefit from not helping you
	No matter what I do, you benefit from not helping me
	In the end, we are not going to help each other



Tag-based co-operation

- People co-operate with members of the same group
  - And discriminate against members of other groups
  - Groups can be recognised by markers or tags
- Kinship co-operation is well understood
  - Adaptive: Your gene helps itself
- The challenge is to explain tag-based co-operation among nonkin
  - In a nonreciprocal environment, e.g. among strangers

Different interpretations of the same model

The armpit effect

BRIEF COMMUNICATIONS

Evolution, 58(8), 2004, pp. 1833–1838

ALTRUISM VIA KIN-SELECTION STRATEGIES THAT RELY ON ARBITRARY TAGS WITH WHICH THEY COEVOLVE

ROBERT AXELROD,[1,2] ROSS A. HAMMOND,[3,4] AND ALAN GRAFEN[5,6]
[1]*Gerald R. Ford School of Public Policy, University of Michigan, Ann Arbor, Michigan 48109*
[2]*E-mail: axe@umich.edu*
[3]*Department of Political Science, University of Michigan, Ann Arbor, Michigan 48109*
[4]*E-mail: rahammon@umich.edu*
[5]*Zoology Department, Oxford University, Oxford OX1 3PS, United Kingdom*
[6]*E-mail: Alan.Grafen@sjc.ox.ac.uk*

Abstract.—Hamilton's rule explains when natural selection will favor altruism between conspecifics, given their degree of relatedness. In practice, indicators of relatedness (such as scent) coevolve with strategies based on these indicators, a fact not included in previous theories of kin recognition. Using a combination of simulation modeling and mathematical extension of Hamilton's rule, we demonstrate how altruism can emerge and be sustained in a coevolutionary setting where relatedness depends on an individual's social environment and varies from one locus to another. The results support a very general expectation of widespread, and not necessarily weak, conditional altruism in nature.

Key words.—Armpit effect, Hamilton's rule, inclusive fitness, Price equation, self-recognition, viscous population.

Received January 9, 2004. Accepted May 4, 2004.

Ethnocentrism

The Evolution of Ethnocentrism

ROSS A. HAMMOND
Department of Political Science
University of Michigan, Ann Arbor
ROBERT AXELROD
Gerald R. Ford School of Public Policy
University of Michigan, Ann Arbor

Ethnocentrism is a nearly universal syndrome of attitudes and behaviors, typically including in-group favoritism. Empirical evidence suggests that a predisposition to favor in-groups can be easily triggered by even arbitrary group distinctions and that preferential cooperation within groups occurs even when it is individually costly. The authors study the emergence and robustness of ethnocentric behaviors of in-group favoritism, using an agent-based evolutionary model. They show that such behaviors can become widespread under a broad range of conditions and can support very high levels of cooperation, even in one-move prisoner's dilemma games. When cooperation is especially costly to individuals, the authors show how ethnocentrism itself can be necessary to sustain cooperation.

Keywords: *in-group favoritism; ethnocentrism; agent-based models; evolutionary models; contingent cooperation*

The crux of the matter

- Co-operation in a one-shot prisoners' dilemma is inherently incompatible with increased fitness
- The model needs to make additional assumptions for tag-based (or any) co-operation to evolve
- These additional assumptions are by necessity driving the results
- Do assumptions related to the armpit effect carry over to explain discriminative co-operation between people?

Main assumption: neighbouring offspring on a lattice

- Share of co-operators with no tags
  - No spatial structure: 3%
  - Lattice structure: 80%
- Share of strategies with four tags
- A spatial structure is necessary and the lattice structure is sufficient for co-operation

	DD	DC	CD	CC
No spatial structure	86	3	10	1
Lattice structure	8	2	76	14

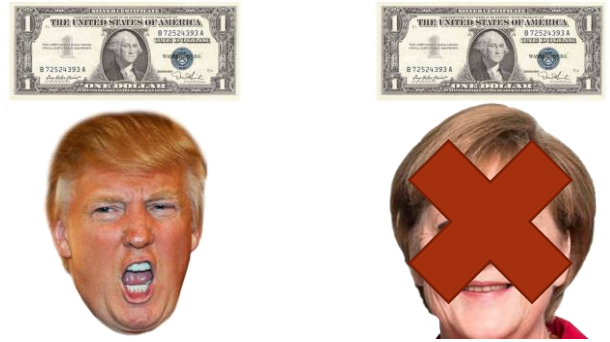
Main assumption: neighbouring offspring on a lattice

- The assumption makes co-operation adaptive
- New target strategy: tag-based defection

Tags show common descent

	Same tag	Different tag
Common descent	71	4
Different descent	9	17

- P(common descent | same tag) = 0.89
- P(same tag | common descent) = 0.95

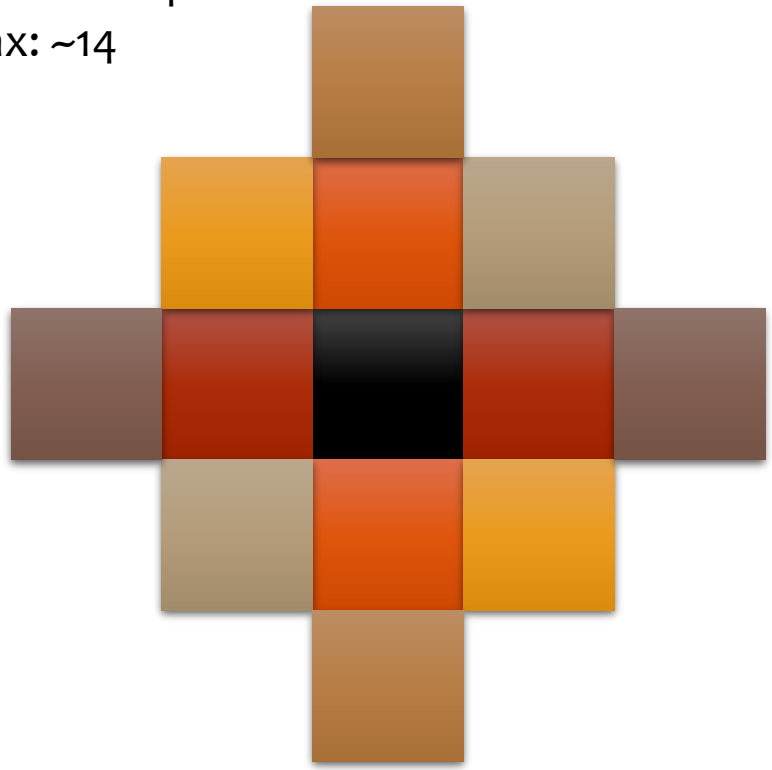


Conclusions so far

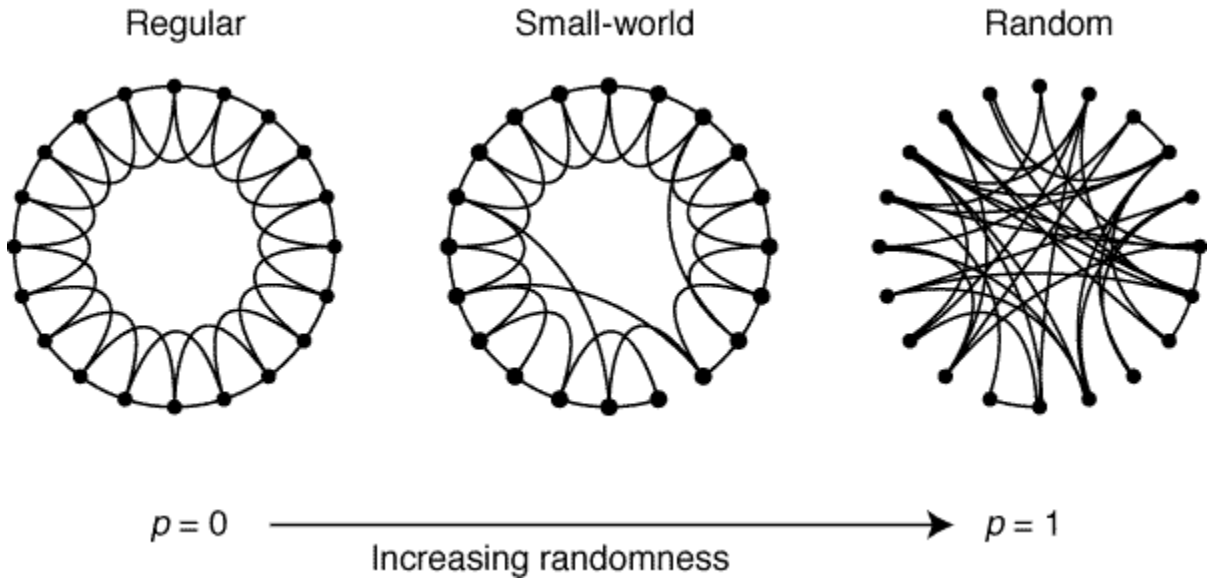
- Neighbours are clones, sharing marker and strategy
- This is an unsound assumption for ethnocentrism
- It this assumption driving the results?
- Can the assumptions be relaxed?

Other spatial structures

Optimum: 4–6
Max: ~14



Similar with close to regular networks



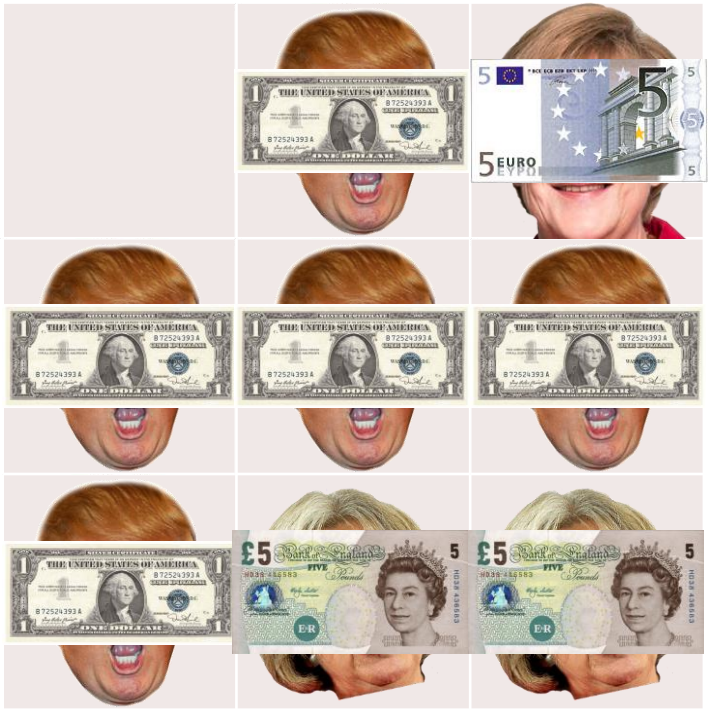
Non-spatial assortment

Markers of common descent

- Kin identification cannot fail too often
  - A large tag mutation
  - Failure to co-operate in every other interaction
- The more tags, the more successful is ‘ethnocentrism’
- ‘Ethnocentrism’ can be invaded by kin identifiers

Conclusions

- The model illustrates the evolution of tag-based defection towards non-clones
- Useful generalisations are not likely
  - Sensitive assumptions
    - a small neighbourhood
    - interactions mostly with clones
    - a copying process that is not too erroneous



Potential application

PNAS

Evolution of cooperation among tumor cells

Robert Axelrod*†, David E. Axelrod‡, and Kenneth J. Pienta§

*Gerald R. Ford School of Public Policy and Department of Political Science, University of Michigan, Ann Arbor, MI 48109; ‡Department of Genetics and Cancer Institute of New Jersey, Rutgers, The State University of New Jersey, Piscataway, NJ 08854; and §Departments of Internal Medicine and Urology, University of Michigan Medical School, Ann Arbor, MI 48109

Contributed by Robert Axelrod, July 19, 2006

The evolution of cooperation has a well established theoretical framework based on game theory. This approach has made valuable contributions to a wide variety of disciplines, including political science, economics, and evolutionary biology. Existing cancer theory suggests that individual clones of cancer cells evolve independently from one another, acquiring all of the genetic traits or hallmarks necessary to form a malignant tumor. It is also now recognized that tumors are heterotypic, with cancer cells interacting with normal stromal cells within the tissue microenvironment, including endothelial, stromal, and nerve cells. This tumor cell–stromal cell interaction in itself is a form of commensalism, because it has been demonstrated that these nonmalignant cells support and even enable tumor growth. Here, we add to this theory by regarding tumor cells as game players whose interactions help to determine their Darwinian fitness. We marshal evidence that tumor cells overcome certain host defenses by means of diffusible products. Our original contribution is to raise the possibility that two nearby cells can protect each other from a set of host defenses that neither could survive alone. Cooperation can evolve as by-product mutualism among genetically diverse tumor cells. Our hypothesis supplements, but does not supplant, the traditional view of carcinogenesis in which one clonal population of cells develops all of the necessary genetic traits independently to form a tumor. Cooperation through the sharing of diffusible products raises new questions about tumorigenesis and has implications for understanding observed phenomena, designing new experiments, and developing new therapeutic approaches.

carcinogenesis | hallmarks | tumorigenesis | cancer

fitness. We marshal evidence that genetically distinct tumor cells cooperate to overcome certain host defenses by exchanging different diffusible products. Our original contribution is to raise the possibility that two nearby subclones can protect each other from a set of host defenses that neither could survive alone, potentially speeding the process of tumorigenesis through the more rapid emergence of malignant populations of cells that contain all of the necessary hallmarks of cancer (Fig. 1). We therefore propose that tumor progression may be facilitated by the evolution of cooperation in the form of by-product mutualism among genetically diverse tumor cells. Our hypothesis supplements, but does not supplant, the traditional view of carcinogenesis, in which one subclone of cells evolves independently to acquire all of the necessary genetic traits to form a tumor. Cooperation through the sharing of diffusible products raises new questions about tumorigenesis and has implications for observed phenomena, designing new experiments, and developing new therapeutic approaches.

Examples of cooperation have been found among a wide range of organisms, from viruses to animals to humans (1–4). It is important to realize that cooperation is not limited to sentient organisms. Cooperation may occur among organisms such as viruses and cells that do not have intent, emotions, sophisticated memory, or any of the other attributes unique to humans or even mammals. A player's strategy is what it does as a function of what it can respond to (although, as will be shown, even this contingent action is not always needed). Two or more players interact, and the payoff for each is influenced by what they all do.

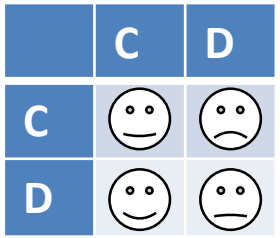
Evolutionary biology now uses game theory to understand the origin, spread, and maintenance of cooperation. The evolution-

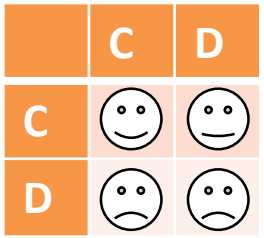
Future directions

- The spatial structure is a way of changing the strategic structure
  - from a one-shot prisoners' dilemma to some other game
- More straightforward and transparent question:
  - Which underlying strategic structures lead to tag-based co-operation?
- New model
  - Random interactions
  - The game is a free parameter

Games of co-operation

- Prisoners' dilemma
  - Whatever you do, I will defect
- Harmony
  - Whatever you do, I will cooperate





Games of co-ordination

- Co-ordination
  - (Oh, oobee doo) I wanna be like you
- Anti-co-ordination
  - I want to do the opposite of what you do

	A	B
A	☺	☹
B	☹	☺

	A	B
A	☹	☺
B	☺	☹

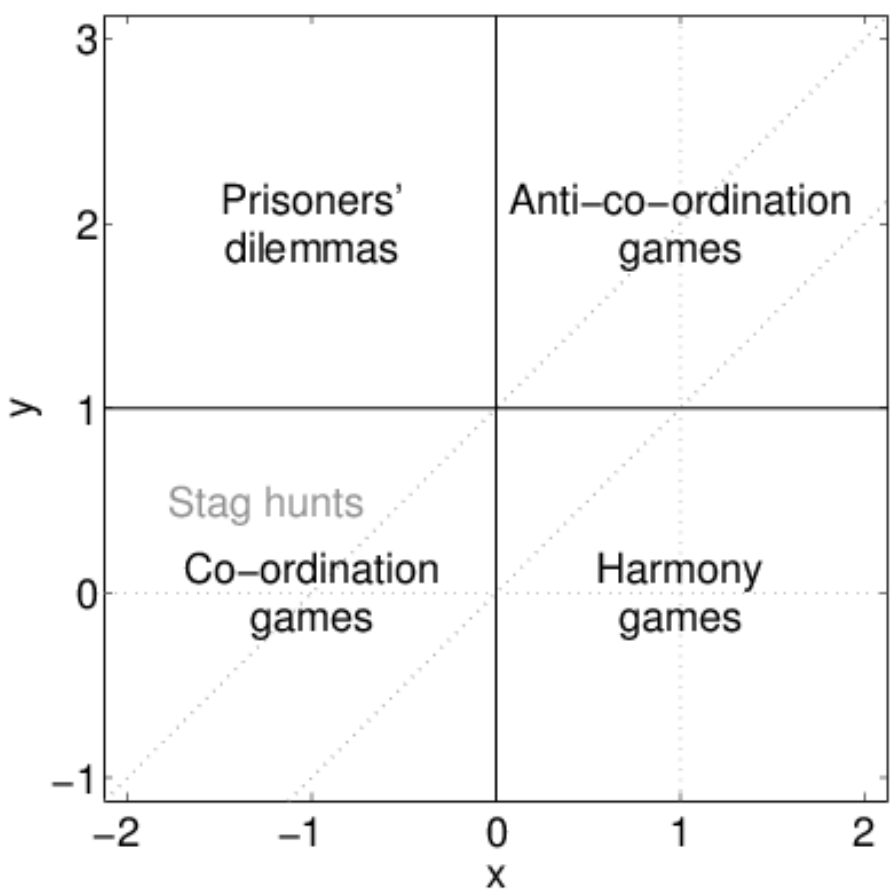
Specific games of co-ordination

- Stag hunt
  - Rowing a boat
- Hawk-dove
  - Cycling a tandem bike

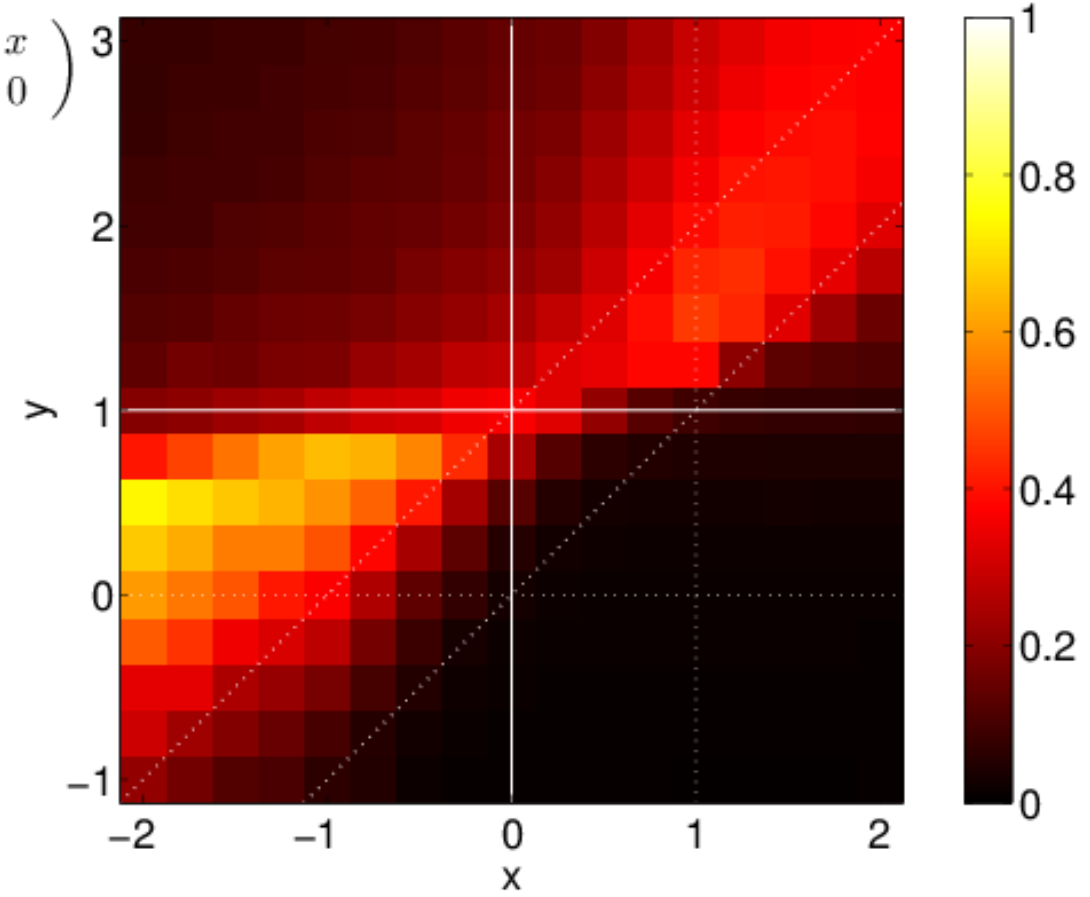
	A	B
A	2	-1
B	0	0

	A	B
A	2	1
B	3	0

Tag-based co-operation in different games



$$\begin{pmatrix} 1 & x \\ y & 0 \end{pmatrix}$$



Further reading

JASSS

Fredrik Jansson (2013)

Centre for the Study of Cultural Evolution, Stockholm University and Institute for Futures Studies, Stockholm, Sweden

Pitfalls in Spatial Modelling of Ethnocentrism: A Simulation Analysis of the Model of Hammond and Axelrod

Journal of Artificial Societies and Social Simulation **16** (3) 2
<http://jasss.soc.surrey.ac.uk/16/3/2.html>
DOI: 10.18564/jasss.2163

Received: 06-Sep-2012 Accepted: 25-Nov-2012 Published: 30-Jun-2013

Abstract

Ethnocentrism refers to the tendency to behave differently towards strangers based only on whether they belong to the ingroup or the outgroup. It is a widespread phenomenon that can be triggered by arbitrary cues, but the origins of which are not clearly understood. In a recent simulation model by Hammond and Axelrod, an ingroup bias evolves in the prisoners' dilemma game. However, it will be argued here that the model does little to advance our understanding of ethnocentrism. The model assumes a spatial structure in which agents interact only with their immediate neighbourhood, populated mostly by clones, and the marker becomes an approximate cue of whether the partner is one. It will be shown that agents with an ingroup bias are successful compared to unconditional co-operators since they only exclude non-clones, but are outcompeted by less error-prone kin identifiers. Thus, the results of the simulations can be explained by a simple form of kin selection. These findings illustrate how spatial assumptions can alter a model to the extent that it no longer describes the phenomenon under study.

Keywords:
Agent-Based Modelling, Ethnocentrism, Prisoners' Dilemma, Spatial Interactions, Validation

Journal of Theoretical Biology 373 (2015) 100–110

Contents lists available at ScienceDirect

Journal of Theoretical Biology

journal homepage: www.elsevier.com/locate/yjtbi

What games support the evolution of an ingroup bias?

Fredrik Jansson [a,b,c,*]

[a] Centre for the Study of Cultural Evolution, Stockholm University, SE-106 91 Stockholm, Sweden
[b] School of Education, Culture and Communication, Mälardalen University, SE-721 23 Västerås, Sweden
[c] Institute for Analytical Sociology, Linköping University, SE-601 74 Norrköping, Sweden

HIGHLIGHTS

- The evolution of an ingroup bias is analysed for various symmetric two-player games.
- In some games the bias evolves even without reciprocity and kin selection.
- This does not apply to co-operation games, but to (anti-)co-ordination games.
- Certain (anti-)co-ordination games are particularly conducive to the bias.
- This includes games relying on trust, such as the stag hunt.

GRAPHICAL ABSTRACT

Both analyses and simulations show that an ingroup bias evolves in (anti-)co-ordination games. The simulations further show that the strategy becomes particularly prevalent in stag hunts. The picture depicts, to the left, the games derived from the game matrix, in the middle, for different values of x and y. The panel to the right shows the simulated proportional prevalence of an ingroup bias for the different games when there are 10 groups in the population.